SCIENCE

FRIDAY, MARCH 16, 1888.

THE MOST INTERESTING and the most valuable article in the *Popular Science Monthly* for March is one entitled 'The Antechamber of Consciousness,' by Mr. Francis Speir, jun. It embodies the result of some carefully planned investigations in psychology for the purpose of weighing anew the argument for unconscious cerebration. The mode of presentation is excellent, and shows an acquaintance with scientific method. The facts are presented by themselves without comment, and the discussion of them follows. The facts, and the writer's opinion concerning the facts, are, as they should be, kept quite distinct. The method adopted for the accumulation of data was the well-known one of distributing printed questions, to be answered from personal experience. The question in which the inquiry centred was, 'Does there exist in man the power to exert intellectual activity during unconsciousness?' The answers are grouped and summarized under four heads; (*a*) when the effort is simple, by reproducing past experiences in obedience to a mandate of the will; (*b*) by comparing related facts, and arriving at a settled judgment; (*c*) when the effort is more complex, by continuing old trains of thought begun in consciousness, and proceeding logically, step by step, to a relative settled conclusion; (*d*) when the effort is most complex, by commencing and continuing new trains of thought without having voluntarily undertaken or continued them, and arriving at results of original creation as inventions, literary and musical creations, etc. Of the first, Mr. Speir says, "Almost every individual says concerning these experiences, 'They are of such frequent occurrence that when they happen I pay no special attention to them.'" Of the second it is said that many people, during a state of perfect unconsciousness, can accurately measure time as well as, and often better than, they can in consciousness. In doing this they may perform an intellectual process similar in all respects to the conscious act of calculating a distance between known points. Of the third, "about eighty-five per cent of those answering claim to have arrived at definite results of work begun in consciousness and left unfinished, at results of a finished logical nature, at results that could come only by bridging the gap between the beginning and partial continuation in consciousness, and the perfected conclusion by predicting the existence and operation of unconscious intellectual effort as the necessary cause of the known result." Of the fourth, "only thirty per cent claim to have suddenly discovered the results of creative effort; these creations appeared suddenly, most often while the individuals were engaged in matters foreign to the discovery." All these voluminous answers could not have been collected without patient effort; and psychologists should be very grateful to the writer for laying so much that is new before them. We trust that Mr. Speir will find time and opportunity to push these investigations further, and to complete his chain of evidence by additional data.

BACTERIOLOGY IN OUR MEDICAL SCHOOLS.

IT was stated in this paper some weeks ago that inquiries were on foot the purpose of which was to obtain information concerning the attitude of our medical schools and training-schools for nurses, toward the germ-theory of disease. For this purpose a circular was sent to each medical school in the country and each training-school for nurses, requesting information on this matter. In most cases the circular was sent to the dean of such institutions, and has asked replies to the questions given below. Answers to this circular have been received from quite a large number of schools, and direct personal inquiry has elicited information from others that have not responded to the circular. In these ways information has been obtained from the following institutions and physicians: —

1. University of Colorado, J. H. Kimball.
2. Medical Department of Yale College, New Haven, Conn., M. C. White.
3. Chicago Medical College, N. S. Davis.
4. College of Physicians and Surgeons, Chicago, Ill., A. Reeves Jackson.
5. Rush Medical College, Chicago, Ill., J. Adams Allen.
6. Medical College of Indiana, J. L. Thompson.
7. Hospital College of Medicine, Louisville, Ky., W. H. Bolling.
8. Medical Department of Tulane University, New Orleans, La., S. E. Chaille.
9. College of Physicians and Surgeons, Baltimore, Md.
10. Harvard College, Cambridge, Mass.
11. University of Michigan, H. Sewell.
12. Minnesota College of Physicians and Surgeons, J. T. Moore.
13. Minnesota Hospital College, F. A. Dunsmoor.
14. C. H. Hunter, Minneapolis, Minn.
15. Kansas City Medical College, Missouri, E. W. Schauffler.
16. North-western Medical College of St. Joseph, Mo., F. A. Simmons.
17. Medical Department of Buffalo University, Buffalo, N.Y., T. F. Rochester.
18. New York Medical College for Women, C. S. Lozier.
19. Medical College of Ohio, J. T. Whittaker.
20. Jefferson Medical College, Philadelphia, Penn., Morris Longstreth.
21. University of Pennsylvania, William Osler.
22. Pulte Medical College, Cincinnati, O., J. D. Buck.
23. Hahnemann Medical College, Philadelphia, A. R. Thomas.
24. Bellevue Hospital Medical College, New York.
25. College of Physicians and Surgeons, New York.
26. Medical Department of City of New York.
27. American Medical College, St. Louis, Mo., E. Younkin.
28. Long Island College Hospital, C. Jewett.

The schools in this list will hereafter be referred to by the numbers affixed against them.

This list includes about one-fourth of the medical schools of the country; but inasmuch as it includes all of the largest schools, the proportion of students thus represented is much larger. Nearly one-half of the medical students of the country are in attendance upon the schools represented in the above list.

The answers received to some of the questions show in many cases so much similarity, that it is not necessary to give them all here in detail. The following summary will indicate the questions, and the substance of the replies: —

Question 1. Is the theory that most, if not all, infectious diseases are caused by the growth of microscopic organisms, accepted by the members of your faculty and the physicians in your vicinity?

To this question the responses have been in the affirmative in almost every instance.

Nos. 3 and 22 change the question so that it reads, "caused or accompanied by," and then answer in the affirmative. This, of course, changes completely the significance of the answer; for, if the causal connection between the microbe and the disease is denied, there is nothing left of the germ-theory.

No. 5 says, "No."

No. 7 says, "Some absolutely, some *cum grano salis*."

No. 12. "Opinions still divided, a majority of the more modern thinkers falling in with that view."

No. 27. "Not wholly."

No. 28. "No, we are not wedded to this theory. It may be true, but it may not."

Question 2. Do you regard the theory as of as much importance as is claimed for it by the various doctors and scientists who advocate it?

With the exceptions noted below, all of the replies recognize that the subject is one of great importance, this conclusion being in general based on the fact that the germ-theory emphasizes and makes possible a scientific study of preventive medicine.

The exceptions are as follows: —

No. 3. "I do not. The adoption of the mere theory as a general proposition does not add any thing to our resources for either curing or preventing disease. Every new fact that becomes clearly and definitely established concerning the existence of a microbe, a ptomaine, or any other material condition accompanying the development and progress of any disease, is of importance, because each new fact is likely to suggest such investigations as will bring to light other facts until results of importance are obtained. The popular adoption of a general theory of disease has in all ages led to an effort to make all facts conform to the theory, and thereby led to many practical errors."

No. 5. "Briefly, no."

No. 7. "No, I do not believe that the bacillus has been proved to be the occasion of disease. May it not be a product? Am open to conviction."

No. 22 says, "Further investigations very desirable. The facts are not all in yet."

Question 3. Do you think the practical value of the subject is destined to be sufficient to demand a wider and more thorough treatment in our medical schools and training-schools for nurses?

To this question a simple or an emphatic affirmative answer was given in all cases where a reply was received, except in the following instances: —

No. 3. "I think the subject receives a full share of attention in all the more important medical colleges, hospitals, and training-schools for nurses in the country. Such is certainly the case in the schools in this city, and in the medical societies also."

No. 5. "No."

No. 6. "I do not, by any means."

No. 7. "The whole subject needs to be further investigated and better understood."

No. 22. "As fast as solid ground is reached. The human mind naturally jumps at conclusions."

No. 27. "There is nothing as yet very practical about the subject: it is mainly theoretical."

Question 4. Is it practical to introduce it into a medical course as a branch of pathology?

No direct reply to this question has been received from Nos. 2, 10, 12, 19, 20, 21, 24, 25, 26. In all of these institutions, however, very special attention is paid to the study of bacteriology, as will be seen in the answers to the next question.

No. 1 says, "Yes, but the ideas advanced should be demonstrable."

No. 3. "Certainly not; and for the reason that microscopic organisms, so far as they act as causes of disease, belong to the department of etiology instead of pathology, and, if any of them are simply developed as products of disease, they belong to the department of morbid anatomy."

No. 5. "No."

No. 6. "No. It could be disposed of in a few sentences; but to make the fuss over it that some lunatics do is an abomination in the eyes of the Lord and man."

No. 7. "Not at present."

No. 8. "This is a question chiefly of finance and of public appreciation of preventive medicine."

No. 11. "I think it not only practical, but necessary to an understanding of pathology."

No. 16. "Yes, and it ought to be done, or intimately associated with it, as we have already done in our school."

No. 27. "Not as a branch of pathology settled, but it is well to treat of the subject so far as science has unfolded."

All others answer with a simple affirmative.

Question 5. To what extent does the subject receive attention in the medical course of the school with which you are connected?

The answers to this question are of so much interest, that they are given here in detail.

No. 1. "Not to any great extent, no pathological laboratory work."

No. 2. "A fully equipped laboratory for bacteriological investigation. A special lecturer is employed to give instruction. In the pathological laboratory attention is given to demonstrations of the presence of bacteria in disease. The subject of ptomaines is taught in the chemical department."

No. 3. "The subject of micro-organisms receives a full share of attention in the practical laboratories of chemistry, histology, pathology, and a well-equipped bacteriological laboratory, as well as in the teaching of every practical department, both didactic and clinical."

No. 4. "All the teachers whose branches bear upon it teach it more or less, though not systematically. We have a professorship which includes general pathology, hygiene, and bacteriology."

No. 5. "More than deserved."

No. 6. "In speaking of the causation of disease, it receives due attention."

No. 7. "Two professors of pathology."

No. 8. "All of the seven chairs enforce the germ-theory of communicable disease."

No. 9. "Special lecturer employed to give instruction on this subject."

No. 10. "Bacteriological laboratory, and a special instructor in this branch."

No. 11. "A special chair of pathology and bacteriology has recently been established, and a well-known scientific worker elected to fill it."

No. 12. "The pathology which I give in connection with theory and practice, when dealing with infectious diseases, includes bacteriology; and I am in the habit of urging the students to investigate the field for themselves, as the branch is not thoroughly developed."

No. 13. "One lecture each in surgery, medicine, obstetrics, and poisons, with four in chair of pathology, and practical microscopical work."

No. 14. "Interwoven in all the teaching. Lectures on micro-organisms, their life-histories, nature of proof that they cause diseases, etc., are given. Different specimens of bacteria are demonstrated."

No. 15. "Is lectured on and demonstrated by one lecturer on histology, who has one hour a week."

No. 16. "The subject is largely taught by the professors in surgery, theory and practice, materia medica, chemistry, gynecology, pathology, and hygiene."

No. 17. "A culture laboratory, and the professor devotes considerable time to bacteriology."

No. 18. "Professor of hygiene teaches in his lectures something of the theory of germ-cells and microbes in disease, and the importance of care and cleanliness; also the danger of eating uncooked or rarely cooked animal food. The professor of anatomy and histology also has given some very instructive discussions in his lectures on the subject."

No. 19. "A fully equipped bacteriological laboratory. The laboratory was furnished directly from Koch's laboratory in Berlin."

No. 20. "In the early lectures of the yearly course on pathology a full exhibition of the pathogenic forms is made by means of the lantern; also lectures on the relation of the micro-organisms to each disease. In the laboratory the class examine with the microscope the organisms in stained preparations of cultures and sections of tissue, etc. The method of culture-preparation, etc., are shown."

No. 21. "In the second and third years a good deal of time is spent by the students in the pathological laboratory. Bacteriology forms part of the regular course of instruction. In the department of clinical medicines the bacteriological questions in relation to diagnosis and etiology are fully discussed, and the clinical laboratory is provided with full means of research in this line."

No. 22. "Incidentally only."

No. 23. "Only in an incidental way in connection with infectious

disease. I have in contemplation introducing a department for study and original experiment in bacteriology in our school."

No. 24. "A competent instructor in bacteriology, trained in Germany."

No. 25. "A well-equipped bacteriological laboratory, with a special instructor."

No. 26. "A special instructor, a pupil of Koch, gives bacteriological instruction."

No. 27. "The facts and investigations are clearly set forth, leaving the subject open to further investigation. We believe that blood-poisoning may not be due to germs. Much depends on ptomaines. Decomposition does not depend on germs. Suppuration has a cause within the body independent of germs. Germs may be the result of decomposition or animal chemical changes. At all events, we are not satisfied on these points."

No. 28. "I can speak of obstetrics only. The student is taught a rigid aseptic practice, and is daily drilled in the methods of sterilizing hand and instruments, etc."

Question 6. Do you think the general principles of the nature of infectious diseases, and the methods and meaning of infection, should be taught the general public through the public school?

The responses to this question have been quite varied, and are of course in all cases personal opinions rather than official replies. These replies are interesting as indicating various opinions on public-school teaching, and a number of them are given below; but since in some cases the request was made that the reply should not be quoted, the replies are given without reference to the source from which they are obtained.

Ten replied with a simple affirmative: others replied as follows:—

"I think that this subject, in connection with general sanitary science, might and should be introduced into the studies of the common school."

"Not yet, except in the way of and in regard to necessary disinfection, cleanliness, and general hygiene."

"Am free to say that the attempt to teach bacteriology generally would be a most misdirected effort."

"It would unquestionably be avantageous could suitable teachers be obtained; but I shudder to think of the statements which would pass current if the subject were made obligatory in even the high schools."

"Not at present, but after the subject is more fully understood."

"No, they would make a botch of it, and teach more falsehood than truth. It needs more acquaintance with the subject than can be expected of non-medical or non-expert teachers."

"Yes. If physiology and healthy function are taught, of much more importance would it be to sow the seed of understanding how to keep those functions healthy in all ways. An elementary work on preventive medicine, including bacteriology, should be taught the young. It should be so prepared that the mind could grasp it without being prepared by a medical education."

"To some extent it should; but so very much is crowded into the children's heads, that they become dazed, and are mere parrots when they get through."

"No, certainly not: first, because not one per cent of the scholars in the public schools have reached the stage of maturity and mental discipline necessary to enable them to comprehend or profit by the teaching of such subjects; second, because the public schools are already over-crowded with so many branches of higher and more abstruse character, that not twenty-five per cent of the scholars are allowed time enough to gain an adequate knowledge of the most rudimentary and practical branches of knowledge. Consequently it is much easier to find boys and girls who can repeat Latin, French, or German, finger a piano, recite verbatim answers from a manual of physiology, etc., than to find those who can write a letter containing one or two hundred words without violating some of the most important rules of orthography, syntax, and penmanship."

"I do not think any one connected with this school would advise the introduction of bacteriology in our public schools."

"First teach the profession, and through them the public. No objection, of course, to extending knowledge in every possible way, but don't think it yet time to expect much through public schools. We must first show more facts."

"No harm, little good."

From the circulars sent to the training-schools for nurses, no responses have been received. This is the more to be regretted, since, if preventive medicine is of value to any one, it is to nurses.

A few words in final summary and review may not be amiss. The question naturally arises, whether the responses from the schools above given can fairly be taken as an average, and whether we can judge of the whole body of medical schools by the replies received from those in the above list. I think it cannot be assumed that this is possible. The above list includes nearly all of the larger schools, and those in which most advanced methods would be expected. It seems quite natural, also, that those institutions which have given any considerable attention to this subject would be more likely to respond to the circular sent by *Science* than those which had not yet regarded the subject as of sufficient importance for careful study. It is almost certain, therefore, that, if responses should be received from the remainder of the medical schools, there would be found a much larger proportion in which the subject is considered only incidentally or not at all, a much larger proportion in which the germ-disease theory is regarded as of little or no importance.

The fact that no responses have been received from the training-schools for nurses can hardly be interpreted as having other significance than that the subject of bacteriology has not received enough attention in these schools to warrant any opinion on the matter.

From the replies above summarized, even though they are less general than could be wished, I think we can fairly draw the following conclusions:—

1. The germ-theory has in the past few years been rapidly acquiring acceptance, is almost everywhere regarded as a subject worthy of most careful consideration, and is nowhere looked upon as an absurd speculation, as was the case a few years ago. The causal connection between specific microbes and definite diseases is not yet, however, everywhere acknowledged by physicians.

2. Quite a number of special bacteriological laboratories have been established in connection with our larger medical schools. They are under the charge of competent directors, and are places where original research is being carried on, and where students have an opportunity to familiarize themselves with the subject in a practical manner. American medical schools are thus doing their share in this research in this matter, and in the endeavor to advance our knowledge of bacteria and their relations to disease.

3. A large number of our schools, probably a large majority of them, do pay considerable attention to bringing to the notice of their students this subject in its theoretical and practical bearings. In some cases it is only done incidentally, in others by a few odd lectures, and in others by regular courses of lectures and laboratory instruction. As much is being done in this line as can be expected, when we remember that not a few of the medical courses are, of necessity, little more than periods of cramming to give the students just enough knowledge to enable them to make ordinary practitioners. The course is frequently so short as to make it hardly a possibility to treat scientifically any subject not directly bearing upon the treatment of disease. It will be noticed that the amount of attention given to the subject is not regulated by the amount of importance placed upon it by those who have answered the circulars. In some cases where the theory is rejected it is still taught in the school; and in others, where it is fully accepted and regarded as of great importance, the amount of teaching is yet very slight. This indicates that it is usually difficulties of finance or otherwise which in many cases have delayed the adequate consideration of the matter.

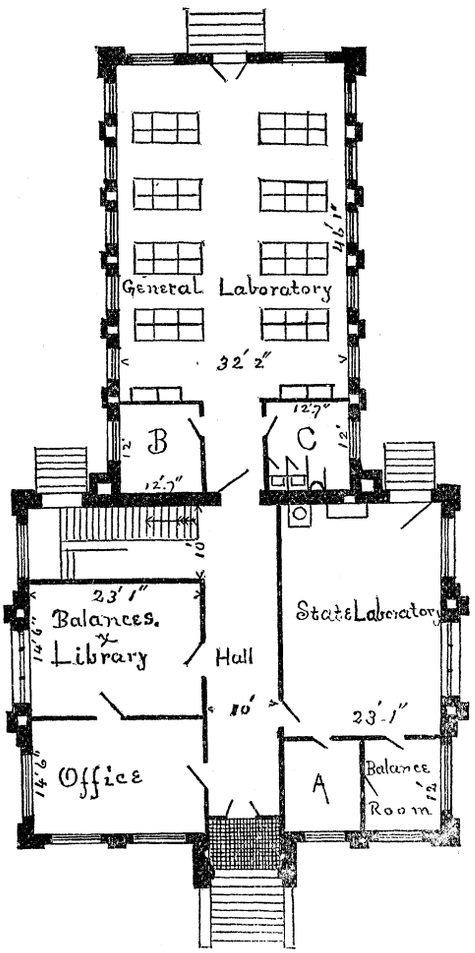
4. It would be the opinion of probably a majority of physicians and teachers, both of those who believe in the importance of the subject and of those who do not regard it as of much import, that the time has not yet come when bacteriology can be taught to advantage in the public schools: at least, this cannot be done until some thoroughly competent person shall have carefully summarized the facts in the form of a short, clear account, which could be used as a text-book. It must be borne in mind, however, that many physicians are, for reasons similar to those given above, opposed to the teaching of physiology in the public schools. This is, however,

generally recognized as advantageous, and in some States required by law. It certainly seems, that, if physiology is to be taught, there would be just as few evils, and much more of value, accruing from the study of the principles of infection and subjects connected therewith, than results from the study of many subjects now taught under the head of physiology. The value of the study of bacteriology in the colleges and universities is more evident, and has been well shown in the letter of Mr. Theobald Smith, published in a recent number of this paper.

In conclusion, then, it may be said that our medical schools and profession generally have been and are advancing along this line of bacteriology as fast as can be expected. All of the larger schools have taken up the subject in a thorough manner, and many of the smaller ones are doing the same. The indications are, that a few years will see bacteriology established as a subject to be taught, either as a branch of pathology or otherwise, in all of the medical schools whose financial condition will warrant it. H. W. CONN.

CHEMICAL LABORATORY OF THE ALABAMA POLYTECHNIC INSTITUTE.

WE present in this number of *Science* a cut of the new chemical laboratory of the Agricultural and Mechanical College of Alabama, located at Auburn. The substantial growth of this institution has been such that the trustees, at their annual meeting in June of last year, authorized the construction of a new laboratory in connection with the Agricultural Experiment Station and the State Department of Agriculture, of which the professor of chemistry is the official chemist, and for original research. At a subsequent meeting in July, it was determined to erect a larger building than at first contemplated, and transfer to it the chemical department of the college.

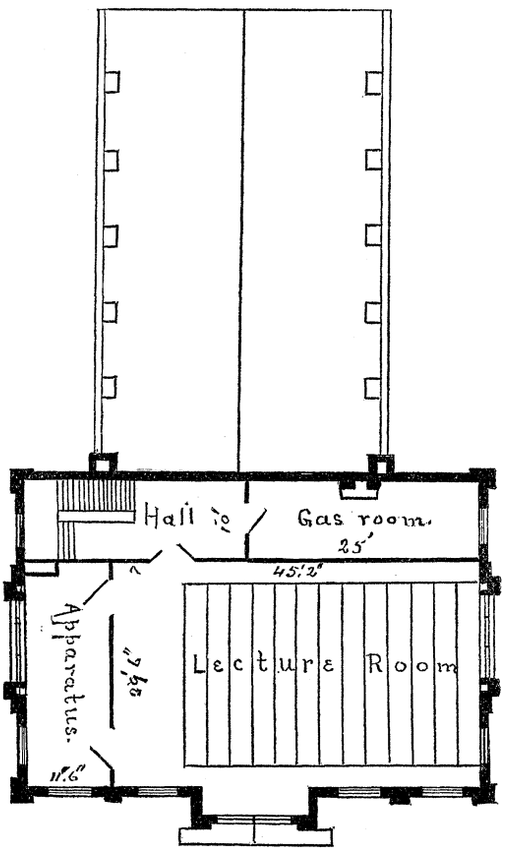


FIRST FLOOR.

A, Spectroscope and polariscope room; *B*, Assistant's private working-room; *C*, Combustion-furnace room.

The building is a handsome two-story structure, 40 by 60 feet, with a stately tower, and a rear projection 35 by 60 feet of one story, and basement. The exterior is of the best quality of pressed brick, laid in red mortar, with cut stone trimmings and terra-cotta ornamentation.

The main floor contains a central hall ten feet wide, with side hall for stairway of the same width, but extending only halfway across the building. On entering through the large archway under the tower, the first room to the left is the office of the professor of chemistry, to the rear of which is the library and balance-room. On the right, extending the whole length of the floor, is the State laboratory and laboratory for research. Two small rooms are cut off from this, one to be used as a balance-room, and the other for the spectroscope and polariscope. Leading from the rear of the main hall is the door which enters the large laboratory for general work. Two rooms are cut off from this, — one for combustion furnaces; and the other, a private working-room for the assistant.



SECOND FLOOR.

In the basement are ample accommodations for assaying and storage. The main laboratory will accommodate sixty students, and, when the fitting-up is completed, will contain the latest improved working-tables, with water, gas, and every necessary appliance for chemical work. Niches in the walls opposite each working-table, with hoods where necessary, connect with flues, and furnish the best possible means of escape for deleterious vapors, while ventilators in the ceiling furnish additional means for getting rid of noxious gases. The pitch is sixteen feet in the clear, with panelled ceiling of oiled Southern pine. The rooms are wainscoted throughout, and finished in natural wood. The second story contains a large lecture-room and room for gas-analysis. Around this lecture-room, suitably arranged, will be cases for containing crude and manufactured products, illustrating the subjects of agricultural and industrial chemistry, which are prominent subjects taught in this institution. Since the war, the South has awakened to an appreciation of her vast industrial resources, and every effort is made to educate her young men in a way that will prepare them to utilize her vast deposits of coal and iron and marble, and other valuable minerals, as well as to maintain, and if possible to increase, the productive capacity of her soil.

ONE YEAR OF INTERSTATE COMMERCE CONTROL. — WHO IS THE GAINER?

JUST one year ago the government laid the iron hand of a Bismarck upon the railways of this nation, their procedure, tariffs, and particulars, under guise and pretext of a provision of the Constitution, framed at a time when railways were unconceived of in the brain of man, and when the only possible object of that provision must have been to prevent internecine commercial hostilities or discriminations among the States. Who has been benefited? The best evidence attainable ought to be the statement of the commission appointed to administer the statute taking control of the railways. In this first annual report the commission says (the Italics are ours), "The Act to regulate commerce has now been in operation nearly eight months. . . . It has operated directly to increase railroad earnings, especially in the cutting-off of free passes on interstate passenger traffic. . . . Freight traffic has been exceptionally large in volume, . . . *no destructive rate wars have occurred*, but increased stability in rates has tended in the direction of stability in general business." In other words, then, it is the railway companies which have been benefited.

But this was not the object of the statute. The railways had not complained of ill treatment. They had, indeed, recognized the immense complications of competing systems, the damage suffered by the people from the rate wars and unjust recoupments for the expenses thereof, and had themselves provided a remedy by the establishment of so-called 'pools;' which, however, the Act of Interstate Commerce promptly and peremptorily abolished. It is something of a commentary on the words we have put in Italics above, that whereas, at the date at which the statute took effect, the situation was tranquil and satisfactory (the 'pools' having lowered rates to a minimum never reached before), the passage of the Act sent tariffs upward at a bound; and before the report above quoted had left the binder's hands, a rate war began in the West whose bitterness has, so far, surpassed in violence any ever known. At this writing the companies engaged have lost, and are daily losing, millions, until several of the roads involved have ceased to solicit freights, because to do no business is cheaper than to move their trains for unprofitable transportation. And it will not fail to add comment to commentary, that while this very Interstate Commission has been sitting calmly at Washington, dismissing trivial complaints against great trunk-railway systems, the ironclad statute which creates it forbids these very warring railways from warding off bankruptcy by coming together, pooling their issues, and terminating the battle which is sapping their resources. Next July the semi-annual dividends will be found adjusted to this rate war, and so the people of the United States will pay all the bills; and the railways, relieved of their burdens, can go on again. But such relief will clearly only be temporary as to them, with the prospect of more wars and more bills for the people to pay. Meanwhile the statute of interstate commerce continues to centralize without adjusting, or attempting to adjust, the larger problems, while carefully hearing and writing opinions as to the least of minor and local particulars of which individuals believe themselves warranted to complain; and this, although the statute itself expressly empowers the commission to take jurisdiction of its own motion, and in the absence of any actual complaint whatever (on grounds of public policy, no doubt; but, upon whatever policy, an opportunity just now very carefully overlooked by this honorable commission).

By the time this paper appears in print, the warring railroad companies will probably have come together in 'conference,' 'committee,' or 'synod,' and terminated the ruinous battle I have above alluded to. Only (in deference to the statutes of united Germany, and the Bismarck policy whose spirit has materialized among us in the shape of an interstate commerce law), whatever they call it, they will be mighty careful not to call it a 'pool.'

But why should the interstate commerce statute be operated to favor the railroads? Such were not the reforms sought. The Interstate Commerce Act was the concentration of popular forces, which had for years fought railway incorporations in our legislatures and in our courts: the crystallized expression of fifty years of popular discontent with railway management throughout this Republic. The people looked to the first utterance of a commission created to administer it, for arraignment of the wrecked railways for their disregard of popular rights, their high-handed indifference to law, and their supercilious contempt for the non-railway element in the community, that should be scathing in its terms, and triumphant in its justification of the government's constitutional right to assume control of a private interest, and to take the first step toward that centralization which Washington deprecated in prospect, which Jackson scotched in its birth, and from the possibility of which a bloody and costly civil war was supposed to have finally relieved. Nor was it mere aimless legislation. The experiment of biennial or even triennial legislatures in some of the States, as tending to decrease the volume of legislation, has always been found to work well. The volumes of session laws of our States are, as to their bulk, apt to become mostly lumber in a surprisingly short time, the number of statutes whose usefulness will survive the first few years of their passage being found a surprisingly small one. And even of our National Legislature it can be fairly said that the more time it wastes, the greater the nation's gain. But the interstate commerce law was no product of mere zeal, or temptation to legislate on general principles. It was the offshoot of sentimental prejudice and jealousy, no doubt; but its fathers and advocates in Congress cannot be suspected of having been actuated by either motive. The vastness of the nation's growth for half a century had rapidly made railroads into systems. The immensity of the plants, the accumulation of costly rolling stock, the huge volume of business, could not fail to impress the people with a sense of power not proceeding, like the power of the government, from the consent of the governed — from themselves. The enormous operations carried on daily in the people's eyes suggested enormous profits, and engendered popular discontent. These enormous operations necessitated new channels and feeders; that is to say, new railways. To save time, the ingenuity of the nineteenth century had devised construction companies, which, by subscribing for the capital of these new roads, should obviate the slow and tortuous collection of money by private solicitation; and these, centralizing profits as well as subscriptions, massed wealth in localities, and attracted the popular envy. The boundlessness of all these brought great bankruptcies for courts to deal with; and the result of each was the inevitable wrecking of great corporations, and the private accumulation of wealth in the hands of the winners in these legal fights. No sooner was this the situation than a new problem intruded itself upon the already complicated maelstrom. The movement known in Europe indifferently as internationalism, socialism, or nihilism (where it grew originally from the discontent of the constantly enlightening and self-educating masses at the support in opulant idleness of privileged classes, useless courts, and — to the people — always absolute monarchies) was utilized to express among us the popular envy, discontent, and prejudice against corporations it felt in Europe only against kings; and the result was felt in strikes, trade-combinations, and central labor unions, where one trade supported another, and each all, in abandoning work by the thousands and ten thousands at one and the same time. Underlying all this was, of course, the capital fact that the railway industry itself was not at fault; was not responsible for the shrewdness of the Wall Street operator: for intentional defaults in dividends and interest procured for wrecking purposes: for the huge competition and the closeness of margins which put them at the mercy of a single disastrous season. The president of a great railway recently asserted, in answer to a demand from the company's employees for higher wages, that in twelve years his company had not only not netted a dollar, but had actually mined and distributed 51,000,000 tons of coal at a cost of $51,000,000, and paid $53,000,000 for the privilege! The margin of profit had disappeared entirely in the giant competition of American railway companies, which yet had given, and was daily giving, support to almost a tenth part of the people of the United States.

But great economic facts like these, like great investments, lose strength by their very immensity. The laborer working ten hours a day, six days in the week, with a family of ten children clamoring for food, cannot be approached with figures showing, that, out of a hundred millions of income, his employer had not been able to reserve one ten-thousandth per cent; that the private fortune amassed by one man in railway wrecking was the crystallization of ruinous losses to thousands of smaller capitalists not of the working-men; that the plant of the great corporations had been paid for by the

hard-earned savings and small economies of thousands more; and, most of all, that, of the total of all these losses and savings, almost a hundred per cent had gone to pay for labor, and for material the cost of which itself was largely the labor of handling it. Such statements as these, few of his betters have the brains to grapple with. The day-laborer may have sundry vague impressions that he should be paid in proportion to the number of his children rather than according to the value of his services; that the idea of anybody handling a million of money is a personal affront; and that altogether he is a slave, and that any change and convulsion, and shifting of bases, could not make him more wretched, and brought an even chance of betterment. He may not even be equal to these ideas, but simply absorb the single idea that the master of his local union has money to occasionally pay him a *per diem* almost as great for not working as he receives from his employer for working. But he knows that he is the slave of somebody. The nearest railway company is to him the most prominent representation of massed wealth, and he accordingly selects it for the slave-driver against whom he is to rebel. Everybody saw the wrong, but the remedy was not so apparent. Everybody sees logically that the railway as an institution is innocent of all this chaos. But logic is one thing, and practical solution, quelling of clamor, amelioration of disasters, are quite another. So it was that when the complicated problem reached the floor of Congress, it was no longer a sentiment, a prejudice, or a jealousy: it was a mighty and imperious fact, demanding and insisting upon immediate attention. Congress passed the Act to regulate interstate commerce, the President approved it, and it was the law of the land. It has been in operation a year. So far as the people of these United States are concerned, has it changed the situation (existing at its approval, and admittedly clamoring for remedy) in the slightest degree? Have strikes ceased? Are rates lower? Have private fortunes disappeared or ceased to be accumulated? Have the railways been curtailed in their despotic sway over the lives, fortunes, and liberties of our people? Had any recipient of a pass over one of our railways, or of a drawback, rebate, or special privilege, complained to Congress that he had been so favored? (That concessions to the few were injuries to the many, and the 'pass' system an unmitigated wrong and nuisance, — these were the complaints of the railway companies, not of the people; and Congress had heard them with ears as deaf as adders' ears for the last quarter of a century.) To these questions some of us are still looking for an answer, others the commission itself has answered for us. The Interstate Commerce Commission (to its credit everlastingly, be it said) did not wait for the filing of its first annual report to come boldly forward and tell the people of the United States that they were in error; that the railways were not their enemies; that, although bound to assume that it had been created for some wise purpose, and therefore to hunt around to find that purpose, the commission did not propose to share in the communistic cry of 'Down with the railways!' or even to admit that railways were a menace to the liberties of the people. It seized upon its first opportunity to assume that the statute of interstate commerce was of no practical value to anybody, but intended to be understood in a purely Pickwickian sense.

That opportunity was the presentation of a petition, on the part of one of the corporations to be brought under the paternal power of the commission, — the Louisville and Nashville Railroad Company, — for relief from the operation of so much of the fourth section of the Act as prohibited railway companies from charging more for the 'short haul' than the 'long haul,' — a prohibition which was and is the gist of the Interstate Commerce Act, and which opens up the entire question of the right of a railway company to judge for itself as to its right to live, operate its roadway, to pay its fixed charges, or generally to conduct the business for which the people had incorporated it. For to say that a grocer may sell sugar, but that if another grocer across the way also sell sugar the first grocer may not compete with the second grocer, is clearly to so embargo the first grocer as to close him out. To be sure, the law added a clause limiting the prohibition to "substantially similar circumstances and conditions;" but the limitation scarcely helped matters, since it merely substituted a question of fact for a question of law, and opened an interminable and costly field for the taking of testimony and the examination of witnesses which could easily paralyze any interest forced to enter it. Besides, to recur to the simile of the grocer, it might be said to permit the retail trade in sugar only on condition that no wholesaling was attempted. He might sell a pound of sugar at any price he could get, but must be careful, if he sold a thousand hogsheads, not to diminish his rate per pound, either by quoting his commodity at less, or by rebating or offsetting for the comparative magnitude of the transaction. Such, then, being the opportunity, the cause of the client, the opinion of the commission in this first case of importance was looked for as an emphatic justification of the law the people had enacted.

But on being promulgated, the opinion, so far as any crimination of the railway companies or any indication of the constitutionality or policy of the law was concerned, turned out to be as unsatisfactory to the non-railway public as Balaam's cursing of Israel was to Balak. "What hast thou done unto me?" cried the disappointed king. "I took thee to curse mine enemies, and, behold, thou hast blessed them altogether." The first pronouncement of the Interstate Commerce Commission begins with an apology for not interfering with the railway companies, which, to say the least, was unique in juridicial literature. It declared (p. 5[1]), that, "if the commission were to perform the inquisitorial duties imposed upon it, it would be compelled to forego the performance of judicial and other functions which by the statute were apparently assumed to be of high importance, and even then its authority to grant relief would be performed under such circumstances of embarrassment and delay that it must in a large measure fail to accomplish the beneficial purposes which it must suppose the statute had in view." The commission deprecated any performance under its inquisitorial function, since that function "in a single case might require for its proper determination the taking of evidence all the way from the Pacific to the Atlantic; and this not merely the evidence of witnesses for the petitioning carrier, but of such other parties as might conceive that their interests or the interest of the public would be subserved either by granting the relief applied for, or denying it" (p. 5). Certainly, nobody can blame the commission for preferring to sit cosily in Washington and exercise judicial functions than to take testimony not only of the parties before the commission, but of any party who might consider himself aggrieved by any act of a railway company or by any proximate or remote effect of such act or its theory, from Maine to California. And, even should the commission be able to decide the matter before it without the bother of hearing testimony, the commission admits that "an adjudication upon a petition for relief would in many cases be far from concluding the labors of the commission in respect to the equities involved: for questions of rates assume new forms, and may require to be met differently from day to day: and in those sections of the country in which the reasons or supposed reasons for exceptional rates are most prevalent, the commission would, in effect, be required to act as rate-makers for all the roads, and compelled to adjust the tariffs so as to meet the exigencies of business while at the same time endeavoring to protect relative rights and equities of rival carriers and rival localities." "This [and here is a touch of nature which shows, at any rate, that an interstate commissioner's life threatened at the very outset to be no bed of roses] in any considerable state would be an enormous task. In a country so large as ours, and with so vast a mileage, it would be superhuman. A construction of the statute which should require its performance would render the due administration of the law altogether impracticable" (p. 5) says the commission finally. And yet, if the Interstate Commerce Act means any thing, it means just what the commissioners, in their first decision, declared to be impracticable, — superhuman and impracticable! Here are seven commissioners, at a salary of seven thousand five hundred dollars per annum, launched with an appropriation of one hundred thousand dollars from the people's treasury, and on that equipment expected to supervise the hourly business of a continent at present in the hands of perhaps a couple of thousand auditors, with a combined staff of a hundred thousand clerks and agents — with salaries ranging from twenty thousand dollars downwards, and overworked at that! But to proceed with examination of the opinion. Having frankly admitted that to endeavor to discharge the functions it was organ-

[1] The references are to the official copy of the opinion printed at the Government Printing-Office, Washington, 1887.

ized to administer would be superhuman and an impossible task, the commission sets to work, as in duty bound, to find something to do. It is legally bound to assume that it was created for a possible purpose, to do something not superhuman. And so the commission, groping, as it frankly admits, in the dark, strikes at last upon the cause, "under substantially similar circumstances and conditions," and finds at last a foothold. Surely, it says, "if the carrier . . . shall depart from the general rule, . . . if the circumstances and conditions of the two hauls are dissimilar, the statute is not violated." Clearly, if Congress shall take the grocery trade under its jurisdiction, and declare that the poor man must not be obliged to pay more per pound for his two pounds of sugar than the dealer pays per pound for his two thousand hogsheads, it would put an end to the wholesale grocery business on the instant. But if Congress says that this rule shall only apply to the sugar made "under substantially similar circumstances and conditions," then the sugar trade may go on in peace, as before, relying on the immutable truth that no like transactions are or can be under the same circumstances and conditions, and foregoing to attempt the 'superhuman task' of taking evidence all over the continent, — from the planters, the cultivators, the harvesters of the sugar-crop, the teamsters who carried it to the railroad, the shipper, the booking clerk, the carrying company, and so forth and so on, down through the jobber, the wholesaler, to the consumer or the messenger sent to pay the twenty or twenty-five cents for the brown paper parcel, — in perfect faith that in no two cases can the adjective clause 'substantially similar' be predicated to any one transaction when collated with any other transaction on record. Certainly the commission is right. Indeed, the wonderful part of the opinion is in the exact legal consistency and candor with which it admits that the law is one, *which, if logical, is impossible of enforcement: and, if illogical, can only be administered by leaving matters precisely as they were before the law was passed!* Following the above line of reasoning, the commission declares (p. 6) that the statute becomes practical, and may be enforced without serious embarrassment. The commission, having settled this much, now proceeds to collate the two sections of the Act which relate to the long and short haul (Sections 2 and 4), and proceeds, "It is not at all likely that Congress would deliberately in the same act, and when dealing with the same general subject, make use of a phrase which was not only carefully chosen and peculiar, but also controlling, in such different senses that its effect as used in one place upon the conduct of the parties who were to be regulated and controlled by it would be essentially different from what it was as used in another" (p. 7). And therefore the commission renders its decision in a sentence which I must be pardoned for putting in Italics: "*Beyond question, the carrier must judge for itself what are the substantially similar circumstances and conditions . . . on peril of the consequences*" (p. 7). But is not this what every carrier (nay, every business-man) does, has always done, and always will do to the end of time? And is not this a pronouncement from the mouth of the Interstate Commission itself, that if the clause 'under substantially similar circumstances and conditions' is of the essence of the Act, then the law is a nullity?

But after having arrived, by application of every rule of law, and the legal construction of statutes, — that is to say, by irresistible logic, — to its conclusion on p. 7, the commission proceeds for twenty-two pages more to discuss analytically and still logically the situation. What situation? The case submitted by the petition, the Louisville and Nashville Railway Company, was simply the case which arises every moment of the day to any railroad company which carries freight for hire; and while considerable percentage of these cases are not necessarily 'interstate' in their character, yet every practical railroad man (certainly every student of political economy) knows that such a character, from a commercial standpoint, could be given to almost every one of them without any difficulty. The remaining twenty-two pages of this startling opinion — startling in that it is a confession at the outset that the Interstate Commerce Act cannot change the situation without discontinuing the business and commercial transactions of the people of the United States — is merely an analytical examination of the reciprocal relations which arise between a shipper and a carrier in any contract of transportation.

The commission proceeds to lay down the following propositions, which it deduces from the case before it, and the evidence taken: —

"1st, That the support and maintenance of a railroad ought properly to be borne by the local traffic for which it is supposed to be built, and the through traffic may justly be carried for any sum not below the cost of its own transportation.

"2d, That the cost of local traffic is greatest, and the charges for carrying it should be in proportion; and, if they are so, they will often result in the greater charge for the shorter haul.

"3d, That traffic carried long distances will much of it become impossible if charged rates corresponding to those which may properly be imposed on local traffic; and it must therefore be taken in recognition of the principle accepted the world over, that the traffic must be charged only what it will bear.

"4th, That the long hauls at low rates tend to build up manufactures and other industries without injury to the traffic upon which rates are heaviest.

"5th, That charges on long hauls which are less than the charges on shorter hauls over the same line, in the same direction, are commonly charges which the carriers do not voluntarily fix, but which are forced upon them by a competition from whose compulsion there is practically no escape."

Since the above propositions are axioms in railway management, and since, however immutable, axiomatic, and eternal they are — were before there was any Interstate Commerce Act or Interstate Commerce Commission, and will be after both have been numbered among the figments of the past; since the commission is not supposed to be organized for the purpose of ruling that black is black, and white is white, — what was left for the commission to say to the railroads of the United States except, "Depart in peace, be ye warmed and filled, you have done nothing worthy of death or of bonds, you have conserved the best interests of the people, have built up a continent, and are worthy of the highest praise"? That is precisely what it does say, for it unhesitatingly adds, "On the construction we give to the statute, these several applications need not have been filed, and therefore they might now be withdrawn without further judgment" (p. 8). But the commission remembered the Act upon which it was created, and that it was expected to justify at least the action of Congress in creating it, and so announced its willingness to go into the merits of the question (it had just decided that there was no question), making its excuse, "that it is manifestly important to the public interest, as well as to that of the railways themselves, that mistakes shall be as far as possible avoided" (p. 9), — (a proposition to which certainly nobody can demur); or to limit these propositions, or discover anywhere a public need or benefit that the management of the railways of the country have overlooked. How should the situation be changed to benefit the people? How can it be changed without destroying our interstate commerce; nay, without destroying the welfare of the country and paralyzing all business transactions? "Every railroad company," says the commission, "ought, when it is practicable, so to arrange its tariffs that the burden upon freights shall be proportionate on all portions of its lines, with a view to revenue sufficient to meet all the items of current expense, including the cost of keeping up the road, buildings, and equipment, and of returning a fair profit to owners." But this is precisely what every railroad does, has always done, and always will do. To attempt to make tariffs other than proportionate would require an increasing of its book-keeping expenses, and of its auditing bureaus, to every railroad company, which would make it cheaper to go out of the business than to continue. In other words (the words of the opinion), "a railroad ought not to neglect any traffic of a kind that will increase its receipts more than its expenses" (p. 22). To state it frankly, therefore, the opinion of the commission, in the case of the Louisville and Nashville Railroad Company, is a benign approval of the business methods of our railroad companies which certainly merits the exclamation of King Barak over the efforts of the prophet Balaam.

And then the commission repeats in detail its already general commendation of the railways of this Republic. It says that they may compete with Canadian railways (p. 22) and with the watercourses (p. 22). And the commission therefore arrives at its rulings

(p. 27), which (except that it interprets the short and long haul clause to mean that a question of fact is thereby substituted for a question of law; and, inferentially, that to determine it the testimony of every individual in the employment of the railway must be taken by the court) *does not in the slightest degree* change the habitude and method of running a railway; does not introduce a single innovation, or modify a single rule of railway operation: in other words, Congress has enacted a statute which a commission chartered to enforce it declares *enacts that things shall remain as they are*, and that, if the statute is ever suspected of interfering with things as they are already, the subjects of the statute must interpret it blindly and at their own peril!

It would seem, therefore, that the commission itself has decided that the railways of this Republic have been, up to the date of its own appointment, properly managed: certainly there is no disapproval of any particular acts, and only in the sixth ruling does it condemn certain possible acts and differentiations which it is not alleged that any railways have been guilty of, and which certainly, therefore, is mere *obita*, or the expression of a general opinion upon a very interesting but entirely gratuitous conundrum of supposititious railway policy. But is not a disturbance of constitutional limitations a rather high price to pay, even for so valuable a boon as is a governmental approval of American railway management? Once broken, who can say what will pass these barriers? Perhaps there may yet be established at Washington an interstate theatrical commission which shall review and absorb the early functions of Master of the Revels, stage censor, and Lord Chamberlain! And, indeed, for such a bill, congress need not again borrow its policy from an Empire of Blood and Iron. It can get its suggestion this time from a Republic — from Mexico — where theatres are not only under the espionage of government, but even the migratory Yankee circus is officially coerced into living up to its posters.

APPLETON MORGAN.

MENTAL SCIENCE.

Morbid States of the Attention.[1]

THE absence of attention is usually termed 'distraction,' but there are really two kinds of lack of attention. In the first there is a constant flitting of the mind from one idea to another, a constant dissipation of the energies in all directions, for which the word 'distraction' may be retained; and there is the lack of attention to the impressions going on about us, due to the fact that the attention is really absorbed in something else, — this is absent-mindedness, which is thus an extreme 'present-mindedness' to a different train of thought, and may be termed 'abstraction.' It is with the exaggeration of one or other of these two conditions that morbid states of the attention are allied. If we take as a convenient definition of normal attention, 'a *temporary* predominance of a mental state with a natural or artificial adaptation of the subject,' then we can distinguish two groups of morbid deviations: (1) an *absolute* predominance of such a state that becomes fixed and cannot be dislodged from consciousness; and (2) a state in which no idea can get an audience, and the attention is too weak to hold an impression steadily in the mind. To this may be added a third group, in which, through congenital defect, the power of attention never develops, as in idiots and the weak-minded.

There are all degrees of transition, from a normal concentration of the attention to the most imperative forms of fixed ideas. We have all been haunted by an aria which we cannot stop humming; have been anxious about a sick friend, so that in spite of ourselves we could think of nothing else. This is a mild form of possession by an idea, that is more persistent than any other, keeps itself in consciousness, and by imperceptible steps passes beyond the control of the will. The profound absorptions of many great men in their work are so much beyond their own control that one cannot but recognize an element of the morbid in them. When the object of reflection is a less worthy one, and the devotion to it, far from coinciding with the intentions of the individual, seems to him as an imposed task, we speak of an insistent idea (*zwangsvorstellung* of the Germans). M. Ribot distinguishes three kinds of such, according as the purely intellectual, the emotional (usually a fear, as the long list of phobias indicates), or the voluntary (usually a morbid impulse to an absurd or criminal act, kleptomania, etc.) predominates. The first class is the most important in this connection. The insistent idea takes many shapes, and in most of these we can trace analogies to our own every-day experiences. There is an arithmetical form of it, that sets the patient to ask, Why are men just so and so high? Why have houses this particular height? and so on. Again: it may be a mania for counting every thing, — the number of pavements on a street, the number of streets in a city. The sight of a bag of grain irresistibly led one patient to estimate how many grains there are in the bag, how many in the country, etc. Another must count all the trains leaving the railroad-station, and keep account of their destinations. In these cases the patients often recognize the morbid nature of their thoughts: they fight against them, know that they are wasting time; but the ideas fill their minds completely, and demand attention with a tyrant's power. A feeling of intense discomfort, of an impending evil if they fail to count the trains, etc., is sometimes associated with the state. There is, too, a metaphysical mania, in which the mind busies itself with unanswerable questions as to the constitution of matter, the final ends of nature, and so on. Persons thus affected are usually of more than average culture; for the concentration of attention implies mental power. Nor are the objects of their thoughts entirely different from ours: the main difference is in the time and the control of these states. We think of such problems for a while, and then pass on to something else: to them that is impossible. In other respects such patients are often perfectly sound, and show great ingenuity in concealing a knowledge of their weakness from their associates. In general, it can be said that a large proportion of persons thus afflicted are the offspring of neuropathic parents, and not infrequently show other and physical symptoms of a degenerate stock. But the environment, education, must be called into account to explain others of them; and each case, especially as regards the particular form that the idea takes, must be studied by itself. The state differs from the normal, then, in degree rather than in kind. It is persistent, it is intense, it allows no relapse to a diffuse condition of the attention, and, as a mark of nervous disorder, it carries with it a weakness of the will that cannot drive out the unwelcome and officious visitor.

A more intense and acute concentration of the attention is to be found in the trance state, or ecstasy. This is allied to contemplation, to absorption in intellectual work, and brings with it an insensibility to outward impressions. When the state is very profound, such impressions can be intense and yet pass unnoticed. Archimedes, during the taking of Syracuse, remains absorbed in his contemplations. Soldiers often do not know they are wounded until the fight is over. Here, again, there is a high degree of mental power necessary, though it is often exhibited by fanatics otherwise mentally inert. But M. Ribot properly distinguishes between the cases in which the object of the contemplation is a sensory one and those in which it is purely ideal, and adds that the fanatics usually display the former kind of extreme attention. As a type of the more spiritual kind of ecstasy, the remarkable confessions of St. Theresa (a Spanish religionist of the sixteenth century) is cited. She describes no less than seven stages of ecstasy which are in a rough way capable of a psychological interpretation. The first is a state of 'vocal prayer;' that is, the praying in a loud voice draws the attention away from the outside world. The second stage is termed 'mental prayer.' The sensory impressions are no longer necessary, the mind being held by the ideas that fill it. The 'prayer of meditation' marks the third stage, which is perhaps only a more intense form of the previous state. The fourth degree is characterized by the 'prayer of passivity.' Here the soul no longer produces, but receives, has truth directly impressed upon it without the need of a logical demonstration. The fifth stage, the 'prayer of union,' marks the beginning of the ecstasy, but it is as yet an instable state, and the possession is not profound. Finally, in the sixth stage, the 'prayer of rapture,' the body becomes cold, speech and respiration are checked, the eyes are closed, the slightest movements require great effort, and in rare cases consciousness is lost. The seventh degree of ecstasy is very mystically described,

[1] Abstract of an article by Th. Ribot (*Revue Philosophique*, February, 1888). See *Science*, Dec. 2 and 16, 1887.

but is only an accentuation of the sixth, with perhaps a deeper loss of consciousness. Here the mind is reduced to a single point, attention is sharpened to the finest focus, and this extreme contemplation seems to be an exception to the dictum of Hobbes, that to constantly think the same thing is not to think at all. Such extreme ecstasy is a rare phenomenon: Plotinus is said to have attained it only four times, and Porphyry but once.

The weakening of the attention is seen in an extreme form in mania which presents a general and permanent exalted excitability of the psychic life. The general diffusion of energy is equally apparent in the prodigality of movements, with often an insensibility to fatigue. No co-ordination of the mental energy requiring an effort of the attention is possible. The same is seen in hysteria, in sleepy conditions, in drunkenness, in children. These semi-morbid states well illustrate the motor element in attention. The power of directing the delicate movements that accompany attention is lacking, and with this the attention itself is weakened. One sees in the effects of intoxication the loss of power over the finer muscles, then over the coarser ones, both accompanied by an impossibility to attend to thoughtful ideas, and then to mental impressions of the simplest kind. In sleep there is to a slight degree a direction of the attention, for the sleeper is more easily aroused by one kind of stimulus than by another; but in general the power of attention is nearly lost. If we pass from the cases in which the power of attention has been lost by disease, to those in which it was never developed, we have a difference of degree alone. Idiots, again, are found incapable of directing their finer muscles, and in extreme cases cannot walk; and the most successful mode of approach to the minds of such defectives has been found to be through the muscles.

By way of *résumé*, we may speak of attention as a prevalent attitude of mind. It may be represented by a straight line bifurcating at either end. In the centre we have the average spontaneous attention: as we proceed to the right, the attention increases in intensity, passing into strong spontaneous attention, then into preoccupation, revery, then into a weak insistent idea. Here the line divides, passing into the two extremes, — a fixed idea on the one side, and ecstasy on the other. Beginning again with the normal, and going to the left, we have voluntary attention as an organic mental habit; and as this decreases, it is of only average power, then it becomes weak, and finally passes into the extreme loss of attention, which may be temporary and acquired on the one hand, or permanent and congenital on the other. These are simply various types: in reality, all kinds of intermediate forms abound.

UNCONSCIOUS CEREBRATION.— In the *Popular Science Monthly* for March, Mr. Francis Speir analyzes the returns to a list of questions quite extensively circulated by him, relating to the unconscious activity of the mind. The questions ask, for instance, of the power of recalling a forgotten word or sense-impression while thinking of something else, or perhaps in sleep; of the power of going through a more or less simple logical process under similar conditions; and of the working-out of original ideas (composition of verses, solution of a problem, new modes of regarding a series of facts, and the like), especially of feats of this kind performed during sleep. The answers unmistakably show that the unconscious learns many an art from our conscious selves without the teacher knowing it; and the relative frequency of really respectable performances going on in sleep is larger than one would, *a priori*, expect.

BOOK-REVIEWS.

The American Journal of Psychology. Vol. i. No. 2, February, 1888. Ed. by G. STANLEY HALL. Baltimore, Murray.

THE coincidence by which this publication and the third part of the Proceedings of the American Society for Psychical Research (reviewed in the last number of *Science*) come to hand at the same time suggests a few considerations regarding the growth of the scientific study of mental phenomena in this country. It does not seem at all hazardous to predict that the 'new psychology' has come to stay, and that nowhere does it give more satisfactory evidence of its power to systematize the various interests of students of mind, and to invigorate with a new life all such topics as had relapsed into the blissful slumber of a final settlement, than in this country. The *Journal of Psychology* comes forth as the distinct organ of the strictly technical and controllable study of all such phenomena as from one point of view are of important interest to the psychologist. In so doing it may incur the criticism of those who see in this step the incorporation of psychology in physiology and psychiatry; but apart from the fact that it is at present extremely difficult to foresee what will and should be the boundaries of that science, it is getting more and more generally admitted that a science takes its character quite as much from the point of view from which it regards convenient groups of the facts of nature as from the particular class of phenomena it takes into account. Moreover, by accenting the importance of the 'specialist' study of psychology, as also by emphasizing the value of a broad view of biological facts for the study of human development, it serves to convince of the error of their ways that throng of dilettanti who regard this as the proper field for their lawless rovings, as well as to indicate the difficulty, if not the impossibility, of a single instructor representing the entire field of philosophical thought.

The work of the American Psychic Research Society inevitably suggests comparison with that of the English society, devoted to the same purpose, and bears this test with great credit to itself. Judicious caution, careful reconnoitring of the general field, attention to details, and an appreciation for the extreme 'slipperiness' of interpretation in this kind of research, characterize the work of the American society. Apart from any interest in the final decision of the questions uppermost in the minds of its members, it is gathering facts of value to the psychologist, and appreciates that its field of work is closely related to that of other specialties, and cannot be carried on without a special knowledge of the possibilities of deception, of the mental traits of semi-morbid individuals, and so on. If one considers the wide-spread and intelligent interest in psychology represented by these two publications, it seems very strange that our best educational institutions have made so little provision for the representation of this branch of science upon their several curricula.

The opening article in this second number of the *Journal of Psychology* is by Dr. H. H. Donaldson, and treats of the relation of the recent researches in neurology to psychology. As the anatomical analysis of the nervous system does in some rough manner bring into rational order many of its functions, it is natural to expect that a deeper knowledge will increase the significance of this co-ordination of structure with function. Again: this co-ordination itself is subject to an evolution, and the anatomical homologue of a certain organ in an animal higher in the scale does not necessarily mediate the same functions as in the lower animal. Man has not only more cortex, but exercises a proportionally larger number of functions with his cortex than other animals.

A paper of great interest is that by Dr. Edward Cowles, upon 'Insistent and Fixed Ideas.' Under this head, Dr. Cowles introduces the detailed and systematic study of the operations of a disordered mind as a worthy object of investigation. The logic that draws conclusions at once analogous and yet opposed to those of common sense; the peculiar association of ideas that brings into connection facts and notions normally joined only in the uncontrolled visions of dream-life or the fictitious world of children; the strong tendency for abstract notions usually simply allowed to stroll through the chamber of consciousness, and be gazed at as a curiosity, to lodge themselves there, and acquire a reality that leads to violent and sometimes dangerous action; and the entire process still appreciated as something abnormal, something to be resisted, — all this is most graphically illustrated in the remarkable case described by Dr. Cowles. It is impossible to outline the history of this instance of a 'fixed idea,' as so much of its value depends on the recognition of the gradual evolution of the morbid from insignificant eccentricities.

The final paper in the series is a detailed criticism, by Dr. Joseph Jastrow, of the methods employed in experimentally determining the accuracy of the several senses. The object of the paper is to rescue this kind of experimental work from the various loose and uncritical processes which it has of late employed.

Besides the original contributions, there is a vast number of reviews, abstracts of papers, notes, etc., covering a variety of topics.

A Text-Book on Roofs and Bridges. Part I. Stresses in Simple Trusses. By MANSFIELD MERRIMAN. New York, Wiley. 8°. $2.50.

THIS work of Professor Merriman exhibits in a remarkable degree the clear, logical arrangement and concise style which characterize his writings on engineering and mathematical subjects.

The preparation of suitable text-books of applied science, and especially text-books on engineering subjects, for students of technical schools, at the present day, is an art that demands something more than a critical knowledge of the subjects discussed. It involves also, in the highest degree, a true conception of the art of teaching; and it may almost be laid down as a rule that the most successful teacher is best fitted to prepare a text-book on the subject which he teaches.

Admirable works there may be on particular branches of engineering: for example, works in which abundance of detail and illustration, the presentation and solution of intricate and unusual problems, and the introduction of whatever may elucidate the subject, furnish to the investigator or professional engineer most valuable and instructive information, but which may be quite unsuitable for the daily use and instruction of the undergraduate student.

During the period of the life of a student when his habits of thought and investigation are forming, it is of the utmost importance that he should become thoroughly imbued with the rational principles and processes of thought which will make him an independent thinker and investigator.

In this work the plan adopted for the computation of stresses in the members or parts of roofs and bridges, is, to use Professor Merriman's own words, "The principles and methods are first established, and then numerous examples are fully worked out to illustrate them and their application to different forms of trusses, while a number of problems are stated for the exercises of students."

This plan is faithfully carried out, the mathematical treatment of the principles and methods being clear and concise, and free from complications.

Professor Merriman's work on the 'Mechanics of Materials,' in the same style, and with similar arrangements, was unsatisfactory only in this, that it seemed to end in the middle of the subject, trussed or braced structures being left out; but the addition of the present work supplies the deficiency, and the two together will now constitute a complete work, admirably adapted to use in the higher technical schools.

Report of the Commissioner of Education for 1885–86. Washington, Government. 8°.

THIS report is the first issued by the new commissioner, Mr. Dawson, and is nearly, if not quite, as far behindhand in its appearance as its predecessors. We believe that the blame for this is to be laid at the door of the Government Printing-Office, at present the most inefficient department of the public service. In arrangement it is far superior to the bulky and confused reports issued by Mr. Eaton. The classification of the statistics, and their mode of treatment, mark a decided advance on what we have been accustomed to. The summary of State school laws is a valuable feature, as are the particularly useful statistics in Appendix X., dealing with education in foreign countries. This report, though good and useful, shows by its failures how essential some revision of the method of classifying educational statistics is. It is the task of a lifetime to extract from them, as at present presented, any answers to a score of pressing and important questions. The commissioner of education should have the power to inaugurate and carry through this much-needed reform.

Elizabeth Gilbert and her Work for the Blind. By FRANCES MARTIN. New York, Macmillan. 12°.

THE subject of this biography was the daughter of the principal of Brasenose College, Oxford, afterwards Bishop of Chichester. She was born in 1826, and was made blind at the age of three by an attack of scarlet-fever; but she was a girl of more than usual intelligence and energy, and, under careful instruction, became a well-educated woman, knowing French, German, and Italian, as well as vocal and instrumental music. She learned also to write a very legible hand; but written arithmetic was difficult for her, though she reckoned easily and accurately in her head.

During her childhood and youth she was always treated, both in her studies and in her plays, as nearly as possible like her sisters; but when she became a woman, and her sisters one by one married and left home, she began to feel her loneliness, and especially to feel that there was no field of usefulness open to her. But having received a legacy from a lady friend, which made her pecuniarily independent, she soon discovered work to do. She saw and keenly felt the difficulties that blind persons have in getting employment, even if they have learned a trade; and she undertook to furnish such employment, so far as her resources would permit. She first opened a store for the sale of goods made by the blind, employing a blind man as manager, she herself assuming the pecuniary responsibility, and meeting all deficiencies at first out of her private purse. To the store a factory was soon added, and the whole placed in charge of an association, which ultimately developed into The British Association for promoting the General Welfare of the Blind. Miss Gilbert was also active in serving the cause of the blind in other ways, so far as she had opportunity to do so; but we must refer our readers to the biography itself for the details of her work. She died in 1885. This story of her life is well and simply told, and we commend it to those who are interested in philanthropic work.

The Orbis Pictus of John Ames Comenius. Syracuse, Bardeen. 8°.

IT gives us a startling conception of the antiquity of Harvard College to recall that this educational classic, which so many persons associate with the middle ages, was written by a man who was solicited to accept the presidency of that institution. Mr. Bardeen deserves the hearty thanks of all educators for reproducing the famous work, and issuing it at a reasonable price. The paper, the binding, the type, are all appropriate. The cuts are unusually clear, and are taken from the copperplates of the edition of 1658; the Latin text is taken from the same edition. The text for the English translation is taken from the English edition of 1727, in which for the first time the English words were so arranged as to stand opposite their Latin equivalents. The cuts are here reproduced by the photographic process, and are not retouched or altered in any particular. We trust the *Vestibulum* and the *Janua* may be similarly reproduced at an early day.

Modern Theories of Chemistry. By LOTHAR MEYER. Tr. by P. Phillips Bedson and W. Carleton Williams. London, Longmans, Green, & Co. 8°.

WHILE editions of 'Die Modernen Theorien der Chemie' have succeeded one another in the original to the number of five, the English-speaking public has waited more than a score of years the opportunity to read in the vernacular a work which, perhaps more than any other of the period, has been influential in broadening and harmonizing the ideas of chemists as to the meaning and connection of the throng of facts which busy workers have amassed. The first edition of this work was projected and issued a quarter of a century ago with the purpose of bringing about just valuations of the theories and hypotheses then in vogue but variously estimated, and of showing the suggestive importance of working hypotheses to investigators. The reception of the edition was such (though the author was so modestly diffident of success, previous to publication, as to abandon a personal dedication which had been determined upon) that two more were published in the same form; and a fourth, revised and rewritten to meet the requirements of the time, was issued, only to be succeeded immediately by the fifth edition, upon which the translation now before us was based. In its present form, the book has assumed more of the character of a handbook or book of reference, and on that account the absence of an index is the more to be regretted. Of works merely elementary, and devoted to the representation of accepted theories without very much balancing of the evidence which has led to their establishment, we have in English several very good examples; but with a single exception (Muir's 'Principles of Chemistry'), and that of comparatively recent production, there has been no work on theoretical chemistry, accessible to the student whose only language is English, of any thing like the breadth of this. Its plan embraces

not only the account of the latest development of chemical theories, but also the more important empirical data upon which the theoretical conclusions are based. Of the three parts into which it is divided, the first discusses the atomic and molecular hypotheses, including such topics as the law of Avogadro, Dulong and Petit, and Mitscherlich; the limitations of these laws, and the causes of observed deviations therefrom; and the periodicity, atomic weights, and properties. The second part, treating of the statics of the atoms, or "the doctrine of the equilibrium of the atoms in their combinations with one another," deals with the forms of combination, the law of atomic linking, and valency, or capacity for saturation. The third part is concerned with the dynamics of the atoms, or "the doctrine of chemical change;" and under this head is put an account of the connection of mechanical disturbance, heat, light, and electricity, with chemical change, and a discussion of the influence of mass action and of the stability of compounds as dependent upon atomic composition and interaction. Careful and cautious weighing of evidence is obvious thoroughout the work; and while the value of hypotheses, regarded simply as approximations to truth as well as aids to work, is insisted upon, stress is laid upon the need of proceeding with judgment, and of keeping separate, so far as may be, those theoretical considerations which are the abstract expressions of observed facts, from hypothetical assumptions which show an appearance of probability which may or may not be lasting. To the chemist who wishes to keep up with the tide, a knowledge of the German language, to the point of being able to follow the current of chemical events in Germany, is a matter of necessity, and most chemists are doubtless familiar with the original of the volume before us; but, for the student just entering the real work of chemistry, this book seems to us the most important which has appeared in English in many years.

The Art of Projection. By A. E. DOLBEAR. Boston, Lee & Shepard. 12°.

THIS is a new edition of a well-known book, first issued about ten years ago. It has been revised, and contains some important additions, especially a series of experiments on vortex-rings. Projection has come to be so extensively employed, not only as a means of illustration, but often as an aid to research, that many books would be required to describe the uses to which it may be put. Professor Dolbear's book will always be useful as a guide to the *technique* of port-lumières, lanterns, sources of light, etc., and it contains a well-selected series of experiments suitable for presentation by this method.

The Art of Investing. By a New York broker. New York, Appleton. 16°.

THIS is the sort of book that will find many readers; for although few people, relatively speaking, can invest, yet many more hope to be able to some day, and every one likes to know how it is done. To many its perusal will be like a glimpse through the curtain at a nobleman's ball to a street gamin. It is cleverly written, and puts in a plain, practical sort of way a great many statements that all who invest believe, but few follow. The truth is, that speculation is more or less a disease, and, when it seizes one, it is apt to run its course, cautions and antidotes to the contrary notwithstanding. For this reason a book of this sort is of little value. Many persons who read it will think that they know better than the author what securities are safe, and what are not. Only personal experience and personal loss will convince them.

Under the head of investing, the author discusses the various investment securities in order, beginning with government bonds. The story of State and municipal repudiation is a sad and disgraceful one, and in consequence the confidence in a majority of the securities issued by State and municipal authority has long since been shaken. Many readers will be interested in what is said about farm loans, and will applaud the writer's conservative yet fair judgment concerning them. Under the head of speculating, the New York Stock Exchange receives a severe castigation, but one which is thoroughly deserved. It is beyond question that that far-famed institution has done more harm to the legitimate business interests of the country than any other single influence. If people can only be induced to keep away from it a little longer, it will die of inanition. Gambling is not very profitable unless some rich outsiders participate in the game. The book will unquestionably be widely read: it is almost too much to expect that it will be widely followed.

NOTES AND NEWS.

DR. BILLINGS of the Army Medical Museum will signalize the removal to the new building near the National Museum by the preparation of an illustrated catalogue. It will contain drawings of all the crude and wet specimens of tumors, cancers, gangrenes, etc., and other objects on exhibition in the museum, besides microphotographs of morbid tissues prepared by Dr. W. M. Gray, the microscopist of the surgeon-general's office. Each picture will be accompanied by a short description of the object illustrated, but there will be no discussion of theories. The work, when completed, will constitute a complete pathology, and will be a most valuable text-book for students and physicians.

— Prof. C. H. Hitchcock of Dartmouth College has just returned from the Indian River region of Florida, where he has been studying the tracks of animals on the sand of the seashore in the hope that they might assist in the interpretation of the fossil foot-marks found in the sandstone of the Connecticut valley in Massachusetts. It may be remembered that the late Prof. Edward Hitchcock of Amherst College devoted a great deal of study to these fossil foot-marks, and published in 1858 a report in which he described, and illustrated by plates, a hundred and nineteen species of insects, worms, mollusca, crustaceans, etc., supposed to have been represented by them. Prof. C. H. Hitchcock is pursuing the same line of study in which his father worked so long, and the result of his recent visit to Florida is that he leans more and more to the opinion that the fossil tracks are chiefly those of crustaceans.

— The February number of the *Journal of the Royal Geographical Society* contains an interesting report of William John Steains's journey to the Rio Dôce in Brazil, and its northern tributaries. The traveller, who first went out to South America in connection with a commercial undertaking and the formation of railways, after having accomplished his duties in that direction, undertook the exploration of this river, only the lower part of which was known, although the territory is so near Rio Janeiro. It is principally the difficulty of navigation of the river, which breaks through the coast range in wild rapids and cataracts, and the hostility of the Botocudo, who inhabit this part of the coast, which prevent its being colonized. The country is covered with primeval forest of wonderful beauty and density, and only a few settlements exist on or near the banks of the Rio Dôce. Steains's paper is accompanied by a valuable map giving the results of his traverse surveys. A comparison with other maps of the river shows their great inaccuracy. Steains's geographical explorations, which lasted for eight months, were comparatively thorough. He not only explored the main river, but ascended several of its northern tributaries, particularly the Rio Sao José, which joins the Rio Dôce at Linhares, and several others. By these trips our knowledge of this region is materially increased. On the Rio Pancas he fell in with a sept of the Botocudo, with whom he lived for a month. His observations on this tribe do not contain any new information, and are not so thorough by far as Ehrenreich's study of these tribes, which were mentioned in No. 239 of *Science*. The exploration of the tributaries of the Rio Dôce, as well as that of the main river, was made very difficult by the numerous cataracts which had to be passed by long portages. From Steains's paper it would appear as though a considerable amount of private and government surveying was going on in Brazil; but very little definite information reaches us so far, and our maps of the greater part of Brazil are still very defective, being founded on very old observations and indefinite reports. From Steains's paper it does not appear whether his map is based upon astronomical observations, or a compass survey.

— Thomas Gray of the University, Glasgow, Scotland, has accepted the chair of dynamic engineering in the Rose Polytechnic Institute, Terre Haute, Ind., and will begin his work next September. Professor Gray is well known in this country for his researches in electricity, seismology, etc., and his work for several years with Sir William Thomson on instruments of precision for electrical measurement.

LETTERS TO THE EDITOR.

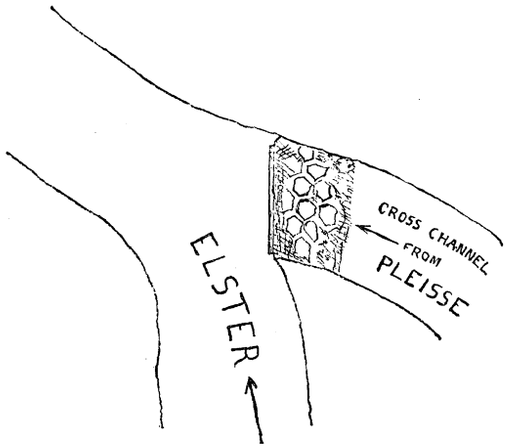
*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Effect of Pressure on Ice.

AN instance of hexagonal figures resulting from pressure seems to be furnished by the ice-masses which were observed in a cross-channel connecting the Pleisse and the Elster at Leipzig. The ice, which was partially dissolved by thawing weather, had been stopped by a beam held by chains across the outlet of the cross-channel.



This beam was in constant vibration, being influenced by the currents of both streams, that of the Elster being the more active. Hence the ice was constantly subject to gentle shocks as it was pushed up stream by the beam, and as it came back again against it. The ice next to the beam, along the walls, which were of cut stone, and farthest from the beam, was of a slushy consistency, but the central portion appeared as roughly shaped hexagons.

The Elster channel is about twenty feet wide, the other about twelve. C. H. L.

Leipzig, Feb. 18.

Vermin-Eaters.

In re the article on vermin-eaters (*Science*, March 2) see BANCROFT, *Native Races of the Pacific States*, ii. p. 234; i. pp. 431, 188; 'The voyage of Johannes de Plano Carpini unto the North-east parts of the world in the yere of our Lord, 1246,' in R. HAKLUYT, *The Principal Navigations*, etc. (London, 1599–1600), i. p. 59; E. BRYANT, *What I Saw in California* (New York, 1849), p. 154; JAMES COOK, *Voyage to the Pacific Ocean, etc., in the Years* 1776–80 (London, 1784), ii. p. 305; *Annual Report of the Smithsonian Institution for* 1866, p. 306; 'The Eastern Tinneh from a MS. by Bernard R. Ross, Esq.,' in GEORGE GIBBS, *Notes on the Tinneh or Chepewyan Indians of British and Russian America; The Travels of Girolamo Benzoni in America, in* 1542–56, translated and edited by Admiral W. H. Smyth, 1858 (*Publications of the Hakluyt Society*, xxi.), p. 9; J. J. LABILLARDIÈRE, *Relation du Voyage à la Recherche de La Pérouse fait par ordre de l'Assemblée Constituente, Pendant les Années* 1791, 1792, *et Pendant la* 1ère *et la* 2de *Année de la République Françoise* (Paris, 1799), ii. p. 50; W. KIRBY and W. SPENCE, *An Introduction to Entomology, or Elements of the Natural History of Insects* (Philadelphia, 1846), p. 136; A. D. RICHARDSON, *Beyond the Mississippi* (Hartford, 1867), p. 190; ANDERSSON, *Lake Ngami*, p. 17.

E. LEWIS STURTEVANT.

South Framingham, Mass., March 3.

Landing Eskimo Boats.

I HAVE just heard from Mr. Henry Elliot of a device invented by the Eskimo for the purpose of landing the skin boat called 'oomiak.' It is probably the most primitive form of 'gridiron' or 'way' known in the world. The Eskimo float is the skin of a seal taken off entire, and arranged so as to be inflated, and fastened to the end of a harpoon-line. This use of the float is well known.

Mr. Elliot informs me that a party of Eskimo travelling in the oomiak take along several of these floats, and when the boat is to be landed upon a rough beach, in order to avoid abrasion by the pebbles, two or three of the floats are inflated, or filled with water; and when the oomiak is about to land, one of these floats is placed under the bow of the boat on the beach. As the oomiak is drawn ashore, other floats are placed along in front of No. 1; so that a series of them acts like a set of rollers, or crib, on which the bottom of the oomiak rests. It is to be understood that these open boats carry frequently a great deal of freight in addition to the passengers: therefore, after the men and women have gotten out, the boat, with its freight, would have considerable weight. If there were no means of easing the bottom over the pebbly beach, considerable damage would be done by friction.

In the study of inventions, this is a very important link in the evolution of those processes which have resulted in the modern dry-dock. While speaking of the float and its functions, it may be of interest to state that one or two of them raised on the top of a pole or harpoon-shaft is a signal that the inmates of the boat are anxious to traffic. This I have also from Mr. Elliot. O. T. M.

Washington, D.C., March 7.

Dried Heads among the Jivaros.

IN the National Museum are two shrunken heads, with nearly perfect features, long, glossy hair, and having the mouth closed by means of a long fringe of cords. There is a doubled braided cord fastened to the vertex for suspension, and others hanging downward for the attachment of colored feathers.

There seems to be some confusion in literature about these heads, and I write this note partly to state what I have learned, and partly to ask for light.

Dried heads are preserved by many South American tribes. Fletcher and Kidder (*Brazil*, 473, illustr.) say,—

"The Tamoyos dwelt formerly in the provinces of Rio Janeiro and Minas Geraes, but, being harassed by colonists, were persuaded by the eloquence of Chief Jappy Assu to emigrate north. They migrated more than three thousand miles to the mouth of the Madeira. Their descendants are now between the Tapajoz and the Madeira, among the lakes and channels of the Tupinambas. They are now called the Mundrucus, the most warlike Indians in South America. They live in villages, in each of which is a fortress where the men sleep at night. This building is adorned within by the dried heads of their enemies decked with feathers."

But the Jivaros, who dwell on the Napo River in Ecuador, do more than dry the heads. They remove all the bones, and shrink the heads until they are no larger than a lady's fist, and are as hard and glossy as polished ebony.

There is an account which says that these people, when they had killed a brave enemy, cut off his head, pounded it with clubs until all the bones within were beaten to a jelly, then removed the bones, and smoked the head until it shrunk to its present proportions. This has always seemed unreasonable, because the pounding would also destroy the skin.

Mr. Charles H. Knight, an American citizen, went to the Napo country, one hundred and eighty miles east from Quito, in 1871, and spent five years there in business. He procured one of these dried heads, which is now in the United States National Museum, from the Achualas, a band of Jivaros, through an old Indian who had seen the preparation. The heads thus treated are always trophies taken from a slain enemy. An incision is made quite through the skin around the neck, well down toward the shoulders. The skin is then drawn off over the head, just as one would do in flaying an animal, cuttings being made whenever muscular adhesion made it necessary. The features are thus left intact. The skin is then soaked in an infusion of some kind of herb, which Mr. Knight did not procure. The second step consists in filling the skin with hot pebbles and sand, over and over, until it is quite shrunken and dry. The soaking in the decoction, and the shrinking and drying, are alternately practised until the trophy is reduced to the desired proportions. The mouth is then sewed up, a cord is passed through the top of the head, and the specimen is hung up in the smoke.

O. T. MASON.

Washington, D.C., March 9.